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## FURTHER INSTANCES OF PARIETAL DIVISION.

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SINCE the publication of my monograph on "Division of the Parietal Bone in Man and other Mammals,"<sup>1</sup> there appeared in print three other direct or indirect communications on that same subject by Frassetto,<sup>2</sup> Schwalbe,<sup>3</sup> and Le Double.<sup>4</sup>

The new instances of the anomaly reported by these authors are as follows:

*A. In human adults.*—1. An antero-posterior complete division of the left parietal in an "adult Savoyard" (Le Double);

2. A complete vertical division, "originating from the sagittal point" and "terminating in the inferior border" of the right parietal, in the skull of an adult male (Le Double). The race of the individual is not mentioned and the description leaves much in doubt.

3. A division in the right parietal of a "heavy, sclerotic," skull of a male Egyptian. The division runs from the coronal to the posterior third of the inferior border, and connects with a trace of a vertical division (Frassetto). As the author states that the usual sutures, even the parieto-temporal, are sinostosed, there is great uncertainty as to the character of the division; it suggests a traumatism more than an anomalous suture.

*B. In human children and fetuses.*—1. An antero-posterior complete division in the right parietal of a seven year old child, sex and race unknown. Skull hydrocephalic (Schwalbe).

2. An antero-posterior complete division in the left parietal

<sup>1</sup> *Bull. Amer. Mus. Nat. Hist.*, Vol. 19, Art. VIII, pp. 231-386, N. Y. July, 1903.

<sup>2</sup> Notes de Craniologie comparée, *Ann. sci. nat.*, pp. 148-187, September, 1903.

<sup>3</sup> Ueber getheilte Scheitelbeine, *Zeitschr. Morph. Anthropol.* 1903, pp. 1-74, Stuttgart.

<sup>4</sup> *Traité des variations des os du crâne de l'homme*, Paris, 1903, "Parietal," pp. 101-141.

of a new born child. Sex and race unknown. Skull hydrocephalic (Schwalbe).

3. An antero-posterior complete division in the right parietal in a female new born child (Frassetto).

4. An antero-posterior complete division in the right parietal of a six months' foetus. Sex and race not given (Frassetto).

5. An antero-posterior complete division in the right parietal

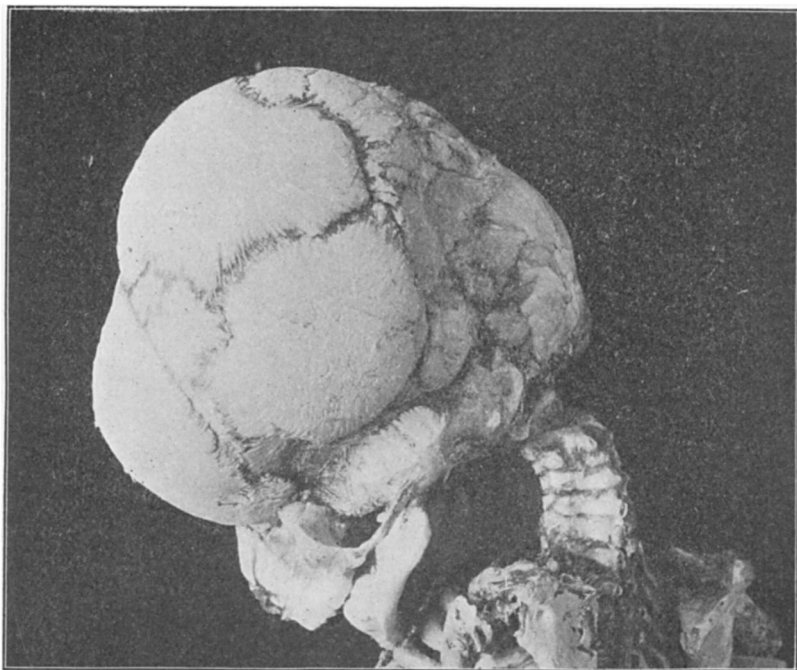


FIG. 1.—Anomalous division of the left parietal bone in a rachitic human foetus.

of a four to six months' foetus, sex and race not given (Frassetto).

6. A separation of the mastoid angle of the left parietal in an infant. Sex, age and race not given (Frassetto).

*C. In Primates.*—1. *Simia sabea* (Cercopithecus). Right parietal divided into four parts. This same case, apparently, is reported by both Frassetto and Le Double.<sup>1</sup>

<sup>1</sup> Frassetto says the skull is No. A-1341 of the galleries of comparative anatomy of the Museum of Paris, while Le Double reports his specimen as No. A-134, in the Museum of Comparative Anatomy, Paris. Neither account is a thorough one.

2. A vertical, curving, complete suture in the left parietal of a young *Semnopithecus* (Frassetto).

3. A vertical, complete suture in the right parietal of a *Cercopithecus callitrichus* (Frassetto).

4. An oblique, vertical, complete, but synostosed suture in the right parietal of a *Macacus sinicus* (Frassetto).

5. A separation of the sphenoidal angle of the right parietal in a Mormon maimon (Frassetto).

D. *Other Mammals*.—1. *Ursus americanus*, young. The



FIG. 2.—Abnormalities of the right parietal in the rachitic human fœtus.

left parietal is divided into four irregular pieces. On the right is found a separation of the sphenoidal angle and an oblique, incomplete suture running downward and forward from the sagittal border near the lambda. This case, too, is reported independently and imperfectly by Frassetto and Le Double.

The new cases of complete parietal division that came to my attention since July, 1903, are briefly these : —

*B.* 1. A human foetus,<sup>1</sup> of white parents, born at term, ninth pregnancy. The child weighed three pounds and lived four days. Whole skeleton highly rachitic.

Both of the parietals, besides other bones of the skull, show considerable modification. (Figs. 1 and 2.)

The left parietal is divided into two by a narrow and somewhat irregular membranous space running antero-posteriorly, very nearly parallel with the line of the sagittal junction, which is also membranous. The upper portion is slightly higher than the lower, its maximum height, measured by a tape, being 4.2 cm., while that of the lower piece is 3.8 cm.

The anterior third of the dividing space is very wide, forming a large fontanel, and this is filled with one large and one smaller secondary bones. Posterior to the two portions of the parietal and between these and the occipital, from the sagittal line to the mastoid, is another space, in the mean 2.5 cm. broad, somewhat narrower inferiorly than superiorly, filled with various sized secondary ossicles.

The squamo-parietal junction and much of the fronto-parietal are still membranous.

On the right there is plainly but one parietal. This is comparatively small and somewhat irregular. In about the middle of the anterior border is a V shaped defect (fontanel), corresponding to that on the left, and filled with a moderate sized secondary bone. The whole fronto-parietal junction is occupied by a row of such bones and the same is true of the sagittal, parieto-occipital and to a less degree the squamo-parietal spaces. One of the secondary bones occupies the antero-superior angle of the parietal area and is of a large size, but is plainly of an accessory character, formed from an accidental accessory focus of ossification. Another larger bony piece occupies the asteric angle.

The skull has been somewhat deformed in preparation or drying and the posterior parietal region on each side is depressed, showing on this account but imperfectly in the illustrations. The bregma fontanel is large and partly filled with small sec-

<sup>1</sup> No. 9754, Army Med. Museum ; gift of Dr. M. D. Spackman.

ondary ossicles. The occipital bone shows the ordinary at this age separation of the squama, exoccipital and basal portions. The development of the temporal bones, particularly the squamæ, is much retarded.

This case is of interest in several ways. It is another instance where the anomaly of parietal division is associated with a pronounced pathological condition of the skull. Such association, particularly with hydrocephalus (some degree of which may have existed even in the skull under consideration), is so common in the children and foetal series of the cases reported that the causal relation of these pathological conditions with the divisions becomes more and more firmly established. They, of course, play the role of the exciting cause only, the fundamental condition which makes a parietal division possible being the presence of two starting foci or centers of ossification of the bone. In this connection one is forcibly reminded of the apparent rarity of pathological conditions in the adult human and also in the ape and monkey skulls with parietal divisions. Even if it be granted that much may right itself during the growth of the skull, it would seem that at least some of the parietal divisions in man and most of those in lower primates must be due to other exciting causes than rickets or hydrocephalus.

The second point of interest in the present case is the presence of two large and plainly *accessory* bones (antero-superiorly and postero-inferiorly on the right) which in an adult skull could easily be taken for primary portions of the parietal. As can be seen in the illustration the small true parietal on the right side shows a marked cleft near the middle of the anterior border. This cleft, it has been amply demonstrated before, is a remnant of the original membranous space between the upper and lower parietal centres. We had here, then, the two normal elementary foci of the bone and in the usual position. But the growth of the already fused primary parietal, due to rachitis, was retarded. Such a retardation in any of the bones of the cranial vault and from any reason leads invariably, undoubtedly through some trophic impulse which regulates the cranial growth, to the appearance of more or less numerous secondary foci of ossification, from which result various sized supple-

mentary, compensatory bones, commonly known as the wormians. Some of these secondary centres, as a rule those in localities where the greatest deficiencies exist, which is at the fontanels, show often more vital strength than others, enlarge to more striking dimensions and eventually, meeting and articulating with the advancing primary parietal, seem to represent and are mistaken for separated parts of this bone. There is no doubt but that the great majority of the "bregma," "human interparietal," and supraoccipital bones, as well as many of the "separated angles of the parietal" belong to this category. The difference between the compensatory bone and one that arose from lack of fusion of the primary centres is morphologically and particularly etiologically important.

The third point that the case at hand illustrates very handsomely is the possibility of a formation of a vertical parietal suture without any division, or totally independent of a division, of the primary parietal. Had the conditions in this skull advanced to a full development and particularly into adult life, before which period many of the closely packed wormians fuse, we should have had, unless an early synostosis obliterated the

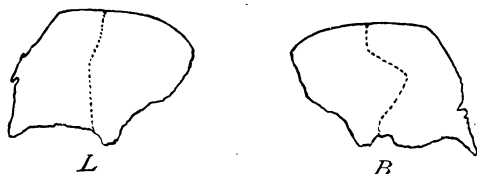


FIG. 3.—Bilateral, nearly obliterated vertical parietal division in a *Hapale*.

feature, a case very much like that of Fusari, which possess, I am inclined to think, falsely as an example of vertical parietal division in a human individual.

C. 1. *Hapale*, male, adolescent (No. 36,222, Dept. of Biology, U. S. Nat. Mus.). Skull apparently normal, symmetrical. The ordinary sutures all open. Each parietal shows a plain trace of a complete, vertical, now synostosed division. On the left the division began superiorly 9 mm. posterior to the bregma and 13 mm. anterior to the lambda, ran, slightly curving and nearly parallel to the coronal suture, to the temporal ridge, then

made a slight bend backward and ended a short distance anterior to the squamo-mastoid junction. The right division began one mm. posterior to that on the left and running a much more angular course terminated in the same relative position as that in the opposite parietal (Fig. 3).

2. *Cebus apella*, male, adolescent (No. 59,298, Dept. of Biol., U. S. N. M.). Skull slightly asymmetrical, surface of bones irregular (rachitis?). No injury. On the left side a serrated, vertical-oblique suture separates a large portion of the antero-inferior angle of the parietal. The anomalous suture begins anteriorly 10 mm. from the point where the coronal meets the fronto-malar suture (there is a bilateral malo-parietal articulation), and 36 mm. from the bregma; it ends inferiorly 14 mm. posterior to the meeting of the malo-parietal with the spheno-parietal suture and 51 mm. anterior to the asterion. On the right side 14 mm. above the point of meeting of the coronal and the frontal suture is a small v cleft in the parietal and from this runs backward and slightly downward a 4.5 mm. long fissure. On the same side exists a 13 mm. long, slightly wavy, vertical fissure in the frontal squama. It rises vertically from the fronto-

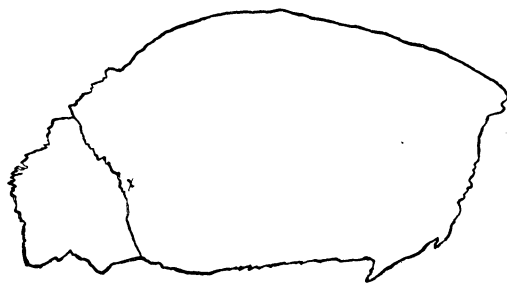


FIG. 4.—The left parietal of a *Cebus apella*, showing a separation of the antero-inferior angle.

malar suture and reaches the frontal part of the crest of the temporal muscle. There is no trace of any violence that might account for this fissure. (Fig. 4.)

The total number of ape, monkey, and lemur skulls examined in the U. S. National Museum was 316. A large majority of these skulls are those of adults, but no specimen was considered in which all the normal sutures of the cranial vault were not



plainly traceable. The varieties, and the parietal divisions found, are as follows :

11	Lemurs . . . . .	no division.
6	Galagos . . . . .	" "
1	Tardigradus . . . . .	" "
11	Propithecii . . . . .	" "
1	Gorilla . . . . .	" "
1	Orang . . . . .	" "
1	Chimpanzee . . . . .	" "
11	Gibbons . . . . .	" "
23	Semnopithecii . . . . .	" "
27	Presbytes . . . . .	" "
8	<i>Simias concolor</i> . . . . .	" "
1	<i>Nasalis larvatus</i> . . . . .	" "
1	<i>Cynopithecus niger</i> . . . . .	" "

82 Macaques no division in 79 ; in one, from Siam (No. 83, 274), there is in the right parietal above the sphenoidal angle a moderate size, curving, antero-posterior fissure ; in one *M. rhesus* (No. 83,476), a vertical fissure runs on the left from the posterior third, on the right from the posterior fourth of the sagittal border towards near the middle of each parietal ; in another, *M. rhesus* (No. 63,379), there is on the left parietal a trace of what was probably a complete vertical suture, running from the middle of the sagittal to the inferior border of the bone.

15 Cynocephali no division in 14 ; in one (No. 22,904), young, there is a partial vertical division in each parietal, left 10 mm. long and starting from between the anterior and middle thirds, right 19 mm. long and starting from between the third and last fourths of the sagittal border.

1 Colobus . . . . . no division.

5 Cercocebi . . . . . " "

19 Cercopithecii no division in 18 ; in one (No. 36,277), there is in the right parietal a vertical-oblique fissure which begins superiorly between the anterior and middle thirds of the sagittal border and runs to the parietal eminence.

34 Cebi no division in 32 ; in one (No. 59,298, described in

- detail), a suture separates the left sphenoidal angle ; in one (No. 82,779), there are two fissures, each 10 mm. long, in the superior third of the coronal border of the left parietal.
- 9 Hapale no division in 8 ; in one (No. 36,222, described in detail) a bilateral complete vertical division.
- 4 Midas . . . . . no division.
- 1 Aotus . . . . . “ “
- 1 Brazil monkey No. 984, there is a 4 mm. long, vertical fissure in the superior border of the left parietal, slightly anterior to its middle.
- 7 Chrysothrix . . . . . no division.
- 2 Lagothrix . . . . . “ “
- 10 Mycetes . . . . . “ “
- 4 Alonata . . . . . “ “
- 1 Nictipithecus rufipes . . . . . “ “
- 16 Ateles no division in 14 ; in one *A. geoffroyi* (No. 8,974), young, the left parietal shows two incisures, one horizontal, 10. mm. long, just above the lower third of the coronal border, and one vertical, 15 mm. long, running from the middle of the sagittal border. In one *A. ater* (No. 63,425), there is in each parietal, a short distance anterior to the middle of the superior border, a vertical, 9 mm. long fissure.

The main facts accentuated by the examination of this National Museum series of monkey skulls is the relative rarity of parietal divisions in adult specimens. The condition in all forms should be sought for preferably in the young. As a rule, synostosis is later at least in some, and at times in all, of the normal parietal articulations than in the abnormal divisions.